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ENGINEERING SPECIFICATIONS AND PROCEDURES

1. PURPOSE

The purpose of these Specifications and Procedures is to provide engineering details necessary to convert REA maps from an allotment basis to a construction basis and then to a final inventory basis, and to outline the procedure to be followed in the preparation of maps and engineering drawings. The document also covers other engineering requirements.

2. PREPARATION OF MAPS

a. CLASSIFICATION:

The existing maps of a System will fall into three classifications:

- (1) Maps prepared in accordance with REA Standards (ADM-49).
- (2) Maps prepared according to other than REA Standards (ADM-49) which the Borrower, with the approval of the Administrator, chooses to continue to use.

(a) BORROWERS WITH EXISTING STANDARDS:

If the Borrower chooses to continue its existing standards, it should immediately make such additions as are necessary to its existing maps to meet the requirements for cultural and physical features of ADM-49. It should be emphasized that all prospective consumers in areas covered by the map system should be added when additional construction is planned.

- (3) Existing maps which have been prepared without regard to any uniform standard.

(a) BORROWERS WITHOUT UNIFORM STANDARDS:

Borrowers having maps prepared according to no uniform standards should immediately secure all field information and other data required so that standard maps may be prepared for additional sections of the System when construction is planned.

b. CONTRACTS FOR MAPPING:

A set of maps showing the complete area of a System, regardless of the standard used, will be prepared or brought up to date by:

- (1) A "mapping only" contract.
- (2) As part of a line construction engineering contract.
- (3) System study engineering contract.

c. FORM OF CONTRACT:

The Regional Construction Engineer will supply the necessary contract forms to enable a Borrower to have prepared:

- (1) A Key Map of the Borrower's entire existing and potential area.
- (2) Detail Maps of all or part of the area shown on the Key Map.
- (3) Additional Detail Maps where the Borrower has existing maps of part of its system.
- (4) A Circuit Diagram.

3. NUMBERING SYSTEM RELATING TO STANDARD MAPS

a. CONSUMER NUMBERING ON DETAIL MAPS:

The consumers and prospects in each of the 100 subdivisions (map areas) will be numbered consecutively in each subdivision beginning with number 1. The numbering should progress from left to right and from top to bottom. The consumer number will be the detail map number, the map area number, the number within the area. For example, Consumer number 5.6.10 is Consumer number 10 in Area 6 of Detail Map 5. The consumer's neighbor in the same map area will be number 5.6.9 or 5.6.11. It will be necessary to prefix the key map number to the member number only in the case of extremely large projects, and then only in correspondence.

- (1) All consumers and prospects will be numbered when the maps are prepared. This numbering system will never become obsolete regardless of how large the System grows or how many consumers are added.

b. SECTION NUMBERING WITHIN TOWNSHIPS:

The mapping "Style Sheet" DS-115 indicates section numbers to be shown in the lower right hand corner of the sections except the numbering at township corners. The Engineer may show section numbers in the center of each section if such location facilitates the interpretation of information shown on the maps.

c. NUMBERING OF TOWN MAPS:

- (1) The town is numbered to correspond to the map area of the Detail Map in which it appears. If for example, Detail Map 5.6 shows Pinedale in map area 25 and this town is mapped to the scale, 1 inch equals 200 feet, then the Pinedale town map will be numbered 5.6.25.
- (2) If there is room on the Pinedale Map to show one or two other towns, this may be done. Suppose Red Oaks is shown on Detail Map 5.7 in Area 35 and 36 and New Elm is shown on Detail Map 5.8 in Area 65. The three towns may be drawn on one town map sheet which will be titled 5.6.26, 5.7.35 and 36, and 5.8.65. The section of the town map which shows the individual town will also show the town name and designation.

- (3) If the town is so large that it requires more area than available on a 29" x 34" sheet, then more than one sheet may be used. In the case of a group of sheets, one sheet shall be used for each map area of the Detail Map.

d. CONSUMER NUMBERING ON TOWN MAPS:

- (1) Each consumer and each prospect in a subdivision of the Town Map will be numbered the same as the Detail Maps. Suppose Pinedale is mapped in the section of the sheet having grid areas 1-5, 11-15, 21-25, and 31-35. Consumer number 5 in Area 1 of this sheet would be 5.6.25.1.5. However, 5.6.25 is Pinedale, so the Consumer number should be reduced to Pinedale 1.5. The consumer's number will be (1) Town, (2) Map Area, (3) Number in Map Area. For example, Pinedale 1.5, Red Oaks 10.2 and New Elm 98.3.

- (2) The Borrower shall determine what areas are to be mapped as Town Maps.

e. WORK ORDER NUMBERING:

All REA Borrowers submit work orders for construction done by their own crews. At present the location of the work is designated according to the Borrower's pole numbering system. Where there is no standard pole numbering system it is difficult to determine the location of construction work being done. Therefore, in the future, the work orders will carry a map location number as well as pole numbers.

f. STAKING SHEET NUMBERING:

When preparing new staking sheets, one sheet shall be used for each map area (one of 100 rectangular subdivisions, Detail Map). The staking sheet will be numbered in the following order: Key Map, Detail Map, Map Area of Detail Map. Thus, 6.42.3 is the number of the staking sheet which shows the construction indicated on the maps in Map Area 3 of Detail Sheet 42 of Key Map 6. If the construction in an area is so congested as to require more than one staking sheet, the sheet number shall be followed by A, B, C, etc., with the notation "A sheet of 3 sheets." This would mean there are staking sheets 6.42.3A, 6.42.3B and 6.42.3C in the complete record of construction.

g. DESIGNATION OF LINE LOCATIONS:

The map numbering system will provide a method for designating line locations. Suppose it is desired to build a line between two points. The Borrower can describe the line by designating terminal and angle points. For example, "The line runs from 5.1.10.1 to 5.7.10.2 to 5.9.10.1." This information will enable the REA to determine the location of the proposed line, and will also facilitate the handling of large power applications.

4. NUMBERING SYSTEM RELATING TO NON-STANDARD MAPS

a. KEY MAP NUMBERING:

The Key Map, insofar as possible, should be numbered according to the Standard State Index Map. The areas of the Key Map which indicate the Detail Map boundaries should be numbered consecutively from left to right and top to bottom.

b. DETAIL MAP NUMBERING:

It is suggested that where applicable the map area designations and consumer numbering system be applied to Detail Maps which have been prepared according to other standards. The Detail Maps should be divided into rectangular map areas which measure 3" east-west by $2\frac{1}{2}$ " north-south. The map areas should coincide with and be numbered according to the areas of a Standard Detail Sheet. The consumer numbering can then be the same as the standard. Note: The area covered by a map area indicator is $2\frac{1}{2}$ " x 3".

5. AREA INDICATOR (DS-120)

A Map Area Indicator which divides each map area of a Detail Map into 100 numbered subdivisions should be used by Engineer and Borrowers personnel to give line location and new member location. Until these indicators can be obtained commercially, one should be made of clear celluloid or other transparent material.* The lines on the indicator can be made with a sharp blade or pointed instrument. Each area should be numbered with a die. The indicator should be used in determining the map location of new prospects, large power applications, etc. A complete title definitely determines a location. For example, Texas 8.20.100 (read eight, twenty, one hundred) means the map is of Texas, in Map Area 100, in Detail Map 20, of Key Map 8. Thus, Texas 7.20.100 would be an area approximately 60 miles west of the first one. *(Attached is a template for making an Area Indicator).

6. SYSTEM AREA BOUNDARIES

The boundaries of a borrower's system shall be determined subject to the approval of the Administrator in order to guide the REA in its consideration of an application for a construction loan and of the proper design of a borrower's system, and to assure the furnishing of adequate electric energy at a reasonable cost to all persons in rural areas who are not receiving central station service. After boundaries have been so determined and furnished to the engineer they shall be shown on all Key and Detail Maps.

7. REDUCED MAPS FOR BORROWERS' USE

The size of the symbols and letters makes it possible to reduce the maps to one-half scale (one-quarter size) and still remain legible. These sheets when bound in a folder are of convenient size for field checking, office records, and maintenance work.

8. REDUCED MAPS FOR REA CONTRACTS

- a. Key and Detail Maps shall be photostated or otherwise reduced to the same size as the sheets in the construction contract ($8\frac{1}{2}$ " x 11") with sufficient margin on the left side to permit binding without obscuring any information. (The top edge may be used if necessary).
- b. When the plans and specifications are submitted to the Regional Construction Engineer's Office in duplicate for review or made available to the Field Engineer for checking, one set of the maps shall be of the original scale. The other set shall be the photostatic copies attached to the specifications. When the plans and specifications are approved and returned to the Engineer, the specifications with the photostatic maps will be returned to the Engineer for inclusion in the contract.
- c. The contractor receiving the award shall receive two sets of the original scale construction drawings to be used in the field. The official copies of the contract should contain only the photostatic copies of the drawings.

9. CONVERSION OF EXISTING MAPS, REGARDLESS OF THE STANDARD, FROM ALLOTMENT TO CONSTRUCTION BASIS

- a. After allotment is made the Engineer will receive from the Borrower a set of tracings. These tracings will show, in ink, all existing lines, members, etc. The signed prospects will be shown in pencil. The proposed lines may or may not be shown on the tracings in pencil. The Engineer will proceed to correct the tracings, in pencil, showing as solid circles the consumers who are to receive service under the construction being planned.
- b. The Engineer will add to or correct the line location in pencil. The lines should be so routed that they will be in the most logical location with regard to servicing prospective members.
- c. No distribution transformers, service size or length shall be shown.

10. PREPARATION OF DETAIL MAPS FOR CONSTRUCTION, INCLUDING DRAFTING OF THE MAPS

- a. The Engineer shall prepare such maps as are required by his Engineering Contract. Although the size of the maps and the geographical limits of the maps may be determined by standards other than ADM-49, the physical and cultural features required for standard maps shall be shown in ink on tracing cloth.
- b. The Engineer shall prepare these maps for construction purposes by following the procedure outlined in 9 above.
- c. In all drafting, the Engineer shall use the full scale style sheet as the correct reference. Reduced size style sheets are included in ADM-49 for illustration purposes only.

11. RIGHT-OF-WAY PROCEDURE RELATING TO MAPS FOR FINAL INVENTORY

- (1) It is the responsibility of the Engineer to satisfy himself that all easements have been obtained by the Borrower before releasing a section of line for construction. The Engineer and the Borrower's right-of-way personnel should coordinate their work to the end that complete easements are obtained and a proper record made thereof.
- (2) As soon as plans and specifications for new construction have been approved by REA, the Engineer shall supply two copies of Detail Maps to the Borrower, one copy to be used by the Borrower's right-of-way personnel to obtain easements; the other copy (hereinafter called the "office easement map") to be retained in the Borrower's office to maintain a record of all easements as they are obtained.
- (3) As staking proceeds, the Engineer shall correct the office easement map to reflect the staked location of the line.
- (4) The Borrower shall proceed to get any additional easements necessary to cover the staked location of the line. Only after the easement map indicates continuous right-of-way for a section of the line, should staking sheets be released by the Engineer.
- (5) The office easement map will then be used by the Engineer to add property lines to the tracings for Final Inventory Maps.
- (6) One copy of the Final Inventory Maps will be used by the Borrower and the Project Attorney in submitting right-of-way proof as required by REA. Ordinarily, very little additional data need be superimposed by the Borrower on such copy to accomplish said purpose.

12. PREPARING MAPS FOR FINAL INVENTORY

a. LOCATION OF LINES:

After construction has been completed, the Engineer will plot onto the Detail Map tracings from his staking sheets the exact location of the electric lines and the consumers served. He will also show transformer size and location, secondary size and location, service size, number and length of wire. The Engineer will letter all points on the Detail Maps which correspond to lettered points on the Circuit Diagram. The Engineer shall plot the exact location of the lines on the Key Maps.

b. PROPERTY LINES:

- (1) When preparing Detail Maps for final inventory purposes, the Engineer shall show in respect of newly constructed lines, as hereinafter prescribed, the property boundary lines of all tracts of land traversed by such lines.

- (2) Property boundary lines shall be shown for a width of 500' or one tier of property, whichever is less, on both sides of the line, unless the line is located adjacent to a roadway, in which event the property boundary lines need be shown only on the line side of such roadway.
- (3) Property boundary lines shall be shown by using a fence symbol (a solid line with crosses spaced thereon every 1/2") (See Standard Style Sheet).
- (4) Every tract of land traversed by the electric line shall be designated by (a) Consumer number, or (b) Tract number, placed between the property boundary lines of such tract (See Standard Style Sheet). Adjacent parcels of land owned by one party or owned in common by several parties shall be considered a single tract for purposes of designation and the showing of property boundary lines.
- (5) Nothing in this section shall be construed to prevent the Engineer from varying the location of the tract symbol on the Final Inventory Maps by reference, in order to avoid congestion on the maps. However, the area close to the electric line for a distance of approximately one-half inch should be left clear to show future consumers and construction detail.

c. POLE NUMBERS ON DETAIL MAP:

Under the engineering service contract, the engineer is required to direct the contractor to install pole numbers (M52-1 or M52-3). Engineering Memorandum, 64R4 states: "Unit M52-1 shall be installed on every 5th pole along right-of-ways visible to the public, on transformer poles, junction poles, tap poles, and sectionalizing or switching device poles." The engineer shall show the pole number installed at transformer, junction, tap, and sectionalizing or switching device poles on the Detail Maps.

d. TRACT NUMBERING ON STANDARD MAPS:

- (1) The tract symbols will be numbered in the same manner as consumers and prospective consumers. The tracts of land shall be numbered consecutively in each map area beginning with the lowest unused number in that map area. The numbering shall proceed from left to right and from top to bottom. For instance, if there are three consumers and two prospective consumers in a given map area, the first tract symbol number will be 6.

e. TRACT NUMBERING ON NON-STANDARD MAPS:

- (1) In connection with borrowers whose maps are prepared in accordance with other than REA standards, the Engineer shall number tracts of land on the Final Inventory Maps using the borrower's established system of numbering.

- (2) In connection with borrowers having no uniform numbering system, the tract of land will take the consumer's number or the consumer's number adjacent thereto, with an alphabetical suffix added, beginning with "A" for each number and progressing along the line in the direction of power flow. For instance, if a section of line crosses five tracts of land, the first of which is occupied by Consumer number 50 (the tract designation), and the last tract of land is occupied by consumer number 51. The intervening tracts of land will be designated as 50A, 50B and 50C.

13. REVISIONS

A Revision Block shall be provided on all maps. No revision shall be made on any map without making the proper revision note. If all the spaces under "Revisions" have been used, a new revision block should be provided to the left of the Title Block. Revisions shall be shown when maps have been changed to construction status and inventory status.

14. COORDINATION OF STANDARD MAPS

From an examination of the Map Standards (ADM-49), it is evident that certain Detail Maps will show areas of two or more systems. Rea will coordinate such sheets. The same sheet will be used by the Borrowers without duplication of fees for duplicate work. Therefore, the Engineer and Borrower's personnel shall determine the availability of maps from the neighboring Borrowers in order to avoid duplication. To keep cost at a minimum, there should be interchange of maps between Borrowers.

15. CIRCUIT DIAGRAMS

- a. A Circuit Diagram shall be prepared on tracing cloth when the first Voltage Regulation Study or Sectionalizing Study is made subsequent to the date of this memorandum. All subsequent studies on the same system shall be made by revising the Circuit Diagram. The Circuit Diagram will be used for both Regulation and Sectionalizing studies.
- b. The Circuit Diagram will be the same size and scale as the Key Map of the system. The border, the Title Block and Revision Block will be the same as on the Key Map. Instead of "Key Map," the title will read, "Circuit Diagram." The boundaries of each Detail Map will be shown on the Circuit Diagram.
- c. The Circuit Diagram shall show (1) all the lines of the Borrower, (2) all substations and wholesale metering points, (3) sectionalizing devices exclusive of distribution transformer fuses, (4) switching devices, (5) fault current symbols and values, (6) voltage symbols, values and mileage, (7) wire size and type, (8) letter-numeral point designations, and (9) tabulation of large power loads. (See full scale "Style Sheet" DS-115 for symbols).

- d. The lines owned by the Borrower shall be traced from the Key Map. No roads or other detail should be shown. Each line must show the individual phases. If there is a three-phase line, there will be three lines side by side on the sheet. Lines on the map should be approximately one-third of the width of the distribution lines on the Detail Map.
- e. The lines indicating multiphase lines shall be separated at least $1/32$ " on the sheet. The phase on the diagram must be shown in the same relative position that the phase occupies on the structure. If phase "B" is the center phase on the structure, it will be the center line on the diagram. If on a particular line there is no center phase, then the phases should be so drawn as to provide space for its later insertion without erasure on the tracing. The individual phase shall be designated at least every six inches on the diagram; at all transposition points, if any; at the point where a phase is dropped, and at all junction points on multiphase lines. Insofar as possible, the center phase of "B" phase shall be used to supply taps closest to the substation and single phase transformers along three-phase lines. If necessary, in order to clearly show the phases at junction points and transpositions, the Engineer can show an enlarged inset on the Circuit Diagram, titling the inset according to standard designation. It is realized the foregoing requirements will cause distortion in the diagram along multiple phase lines. The Engineer is required to obtain mileage figures from the most accurate source, such as available field surveys, Detail Maps, or Key Maps. The Engineer shall not scale the Circuit Diagram in order to obtain mileage data.
- f. In the lower corner of the Circuit Diagram, in the space outside the geographical limits of the sheet, the Engineer shall show a "Large Power Load" chart. This chart shall have four columns titled (1) Point, (2) Installed KVA, (3) Demand KVA, and (4) Type of Load. "Point" is the point as designated on the Circuit Diagram. "Installed KVA" is the KVA of the transformers. "Demand KVA" is the billing demand from the Cooperative records. "Type of Load" is sawmill, cottongin, etc. "Large Power Loads" are defined in Engineering Memorandum No. 113R or subsequent revisions.

16. PHASE DESIGNATION FOR CIRCUIT DIAGRAMS

- a. Beginning at the load side of the substation or metering point, the three-phase line or "V" phase, if there is no three-phase line, or single phase, if there is no "V" phase line, which bears true north or closest to true north in a clockwise direction, will have its phase designated A, B, C, from left to right, facing in the direction of the power flow.
- b. A second three-phase line in a clockwise direction, from the same substation, will be designated 2A, 2B, 2C, as determined by the A, B, C phases above. A third line would be 3A, 3B and 3C.

- c. The points along the phases will be designated by phase and number. Begin numbering by assigning a numeral to each point along the multiphase lines. The sectionalizing devices on the load side of the substation will be number 1. The phase designation will be added after all numerals have been assigned to the multiphase lines. Suppose there are five points which require designation along a three-phase line. The points will be assigned numbers 2, 3, 4, 5 and 6. If the first two points away from the substation are to be on phase A, they will become A2 and A3. If the next point is on phase B, it becomes B4. The next two points would probably be C5 and C6. The end of the three-phase line would be A7, B7 and C7. This will result in unused phase designations such as B2 and B3 on the multiphase lines. Continue the numbering at each phase beginning with 8 to the end of the line which will be where N equals highest number used. In general, the higher the designation the greater the distance from the substation; i.e., A9 would be farther from the substation than A2 or A7. Points on B and C phases would be designated as B1, B4, B7 - - - BN, or C1, C5, C6 - - - CN. On the second three-phase circuit the points will be designated as 2A1, 2A5 - - - 2AN; 2B1, 2B5 - - - 2BN; 2C1, 2C2, 2C3, 2C4, 2C5 - - - 2CN.
- d. If, after the Circuit Diagram has been prepared according to the foregoing system of numbering, it becomes necessary to provide additional intermediate points, for instance, where taps are taken off existing lines, these points will be designated by the addition of a decimal after the designation of the adjacent point nearest the substation. For example, if the line is tapped between points A2 and A3, the new point would be A2.1. The other points on the tap will be designated as shown below.
- e. If a line is extended, the original numbering will be continued. Suppose the end of a line on the original diagram was designated as A20 and the lowest unused number is A31, the the first point on the extended line would be A31, etc.
- f. Circuit Diagram points shall be shown at (1) substations, (2) beginning of taps more than one mile long; (3) end of taps more than five miles long, (4) phase change points, (5) wire size change points, (6) large power loads, (7) sectionalizing points, (8) at least every ten miles along each phase. Conductor designations shall be shown near (1), (2), (3), (4), (5), (7) and (8). Fault currents shall be shown at (1), (3), (4), and (7). Voltage regulation shall be shown at (1), (3), (4), (5) and (8).
- g. The proper symbol shall be drafted on the Circuit Diagram in ink. All figures except the mileage figure for voltage regulation will be placed on the tracing in pencil to facilitate revision. The figures shall be limited to one decimal place.

17. ELECTRICAL DATA SHEET

- a. When the Circuit Diagram is prepared, the Engineer shall prepare an Electrical Data Sheet for each source of power. This sheet will be the same size and have the same border and title block as the Detail Map. The title shall read, "Electrical Data." This sheet shall show (1) Schematic Diagram of the substations, (2) One line, or schematic diagram of power supplier's system, (3) Coordination Chart, (4) Load-phase Chart, and (5) Sectionalizing Schedule. The figures in (4) and (5), which are subject to revision, shall be placed on the tracing in pencil. Items (1) to (5) inclusive, shall conform to the specifications below:

(1) SUBSTATION SCHEMATIC DIAGRAM:

At some convenient location on this sheet the Engineer shall show a schematic diagram of the substation or substations, showing electrical details and all equipment. The Engineer should use standard symbols as contained in A.I.E.E. Publication 232.3, 1943, "American Standard for Graphic Symbols for Power Control and Measurement" (40 cents).

(2) ONE-LINE DIAGRAM:

Near the above schematic drawing, or as part of it, the Engineer shall show a schematic or a one-line diagram of the power supplier's system between the borrower's substation or metering point and the power supplier's transmission system. If the source is an isolated generating plant where no 22 KV, 33 Kv or higher transmission is involved, the diagram shall show the complete circuit between the borrower's substation and the source of power, including all generating units, size and voltage of all units and transformers. The length and size of conductors in the circuit will also be shown. Maximum, nominal, and minimum voltage of generation or transmission will be shown at the generating plant or at the point of connection with the transmission line and at the wholesale metering point. If the power supplier varies the transmission or generation voltage to correct regulation, the hours of such operation shall be shown following the three voltage categories. The above voltages shall include the effect of the borrower's load. Minimum and maximum, three-phase, line to line, and line to ground fault currents shall be shown on both sides of the borrower's substation. The fault currents shall be based on supply and load side voltages.

(3) COORDINATION CHART:

The Engineer shall prepare an A.I.E.E. Standard Logarithmic Chart on the Electrical Data Sheet for each source of power on the project. (Refer to Keuffel and Esser "Time-Current Characteristics No. 336E"). The chart shall have a current scale not less than 10,000 amperes and a time scale not less

than 100 seconds. The coordination chart shall show the time-current characteristics of all sectionalizing devices used on the system, including transformer fuses, primary or internal, and secondary, if any, line fuses, supply substation fuses, reclosers and relays. Primary fuses beyond oil circuit reclosers need not be shown if the chart thus becomes congested. The current ratings of all fuses shall be reduced to the same voltage base.

Superimposed on this graph shall be the damage time curve of all transformers used on the project, (A.I.E.E. Standard). These curves are included in Engineering Memorandum No. 120R, "Location and Size of System Sectionalizing Devices." In all cases, the curves shown shall be those upon which the coordination study was based. All curves shall be clearly designated giving (1) current rating, (2) type, if more than one type of fuse is used.

(4) LOAD-PHASE CHART:

A Load-Phase Chart shall be prepared for each substation or source of power. Each chart shall be titled as above. There shall be five columns to each chart titled (1) Phase, (2) Consumers, (3) Ultimate, (4) Connected KVA, and (5) Ultimate KVA. These mean phase A, B, C and 2A, 2B and 2C (if there are two three-phase circuits out of substation) corresponding to the Circuit Diagram. "Consumers" is the number who will receive service when the signed consumers are connected. "Ultimate" is the total ultimate number of consumers who will receive service along the lines shown. "Connected KVA" is the load of the consumers. "Ultimate KVA" is the estimated load of the ultimate consumers. Vertically under "phase" will appear A, B, C, Total; or A, 2A, Subtotal; B, 2B, Subtotal; C, 2C, Subtotal; Total; or A, 2A, 3A, Subtotal; B, 2B, 3B, Subtotal; C, 2C, 3C, Subtotal; Total. The subtotal is the consumers, KVA, etc. on substation phase A or B or C. The total is the sum of all phases. Thus, the column "Consumers" might show A 50, 2A 100, Subtotal 150; B 75, 2B 75, Subtotal 150; C 90, 2C 70, Subtotal 160; Total 460.

(5) SECTIONALIZING SCHEDULE:

A Sectionalizing Schedule for each source of power shall be prepared showing all switching and/or devices used in coordinating the primary circuit exclusive of distribution transformer fuses. The chart or schedule shall have six columns titled from left to right (1) Point, (2) Unit, (3) Size, (4) Catalog Type, (5) Manufacturer, and (6) Remarks. "Point" is the location as shown by standard designation on the Circuit Diagram. "Unit" is the standard construction unit as shown in DS-7. "Size" is the ampere rating. If a cutout is to be used only as a switch, "S" will appear in this column. "Catalog Type" is the manufacturer's designation, and "Remarks" is for special instructions regarding operation or selection of the device.

18. OTHER ENGINEERING DRAWINGS AND PLANS

a. SUBSTATION STRUCTURE DRAWINGS:

All substation drawings prepared by the Engineer shall be prepared on tracing linen measuring 30" x 36". The border on each sheet shall conform to the border on the standard Detail Map. It shall have a trim measurement of 29" x 34" and a work area of 26" x 31 $\frac{1}{2}$ ". This corresponds to the heavy black border on the Detail Map. The scale of the working drawings shall preferably be one-fourth inch to the foot. The designation shall be "Substation Structure" instead of "Detail Map." The map location will show the location of the substation. The sample Detail Map in Mapping Standards (ADM-49) shows a substation located at Oklahoma 14.6.49. The map area number 49 will appear under "Town" in the title block. Where there are a series of several sheets this notation shall appear under the location number, "Sheet 1 of 6 sheets," etc.

b. BUILDINGS AND STRUCTURES:

All plans for buildings and structures shall conform to the specifications for Substation Structure Drawings.

c. GENERATING PLANTS:

All plans for Generating Plants shall be prepared on sheets which conform to the requirements for Substation Structure Drawings.

d. LOCKER PLANTS:

The drawings for Locker Plants shall conform to the requirements for Substation Structure Drawings.

e. PLAN AND PROFILE DRAWINGS:

- (1) Plan and Profile Drawings shall be made for transmission lines as required by the Engineering Contract.
- (2) Plan and Profile Drawings shall be made for sections of distribution lines where such drawings are necessary to insure an accurate, economical engineering design.
- (3) The drawings shall be prepared on standard plan and profile paper. The sheet shall have a maximum trim dimension of 29" from top to bottom and 34" from left to right. A binding edge shall be provided on the left-hand edge similar to that on a Detail Map. The sheet shall be approximately one-half plan and one-half profile section, with the profile at the bottom of the sheet. The profile section shall have ten divisions per inch vertically and two, or ten divisions per inch, horizontally. The sheet shall have the same border, title and revision block as that of a Detail Map. The designation of State, Key, Detail Map, Area, shall indicate the area of Detail Map which is covered by the profile sheet. The Map area number shall be placed under "Town" in the title block.

(4) The Profile Drawings shall be to a scale of one inch equals 400 feet horizontally, and one inch equals 40 feet vertically. If greater detail is needed, the scale may be one inch equals 200 feet horizontally, and one inch equals 20 feet vertically.

(5) The final draft for Plan and Profile Drawings for transmission line shall be in ink on tracing cloth.

19. STAKING SHEETS

a. The drawing on the staking sheet shall be to an approximate scale. However, this shall not be construed to prohibit the use of printed staking sheets having a uniform spacing between pole locations. The drawing shall show (1) Location of line, (2) Location of all poles, (3) Location of anchors, (4) Location of transformers, (5) Location of consumers, (6) Location of prospects, (7) All roads, public or private, and all trails crossed by the line, (8) Location of all foreign power and communication lines, (9) All angles in the line indicated in degrees, (10) The location of all fence lines, whether property lines or not, which intersect the power line.

b. If the power line traverses private property, the fence line intersecting the power line shall be shown by approved symbol about one inch in length on either side of the line. If the power line lies along and adjacent to a roadway, the fence line which intersects the power line shall be indicated only on the side of the roadway where the line is located. A North directional arrow in its true relation to the start of a line or the longest tangent in that section of the line shall be shown on each staking sheet.

20. OTHER DRAWINGS

Other drawings for construction purposes or to be used as part of the construction record of a project shall conform to the requirement for Substation Structure Drawings. This does not apply to drawings of assembly units intended for insertion in the construction contract.

21. SUBMISSION OF MAPS, DRAWINGS AND OTHER DATA TO REA AND THE BORROWER

a. MAPS REQUIRED UNDER MAPPING CONTRACTS:

Under the Engineering Service Contract the Engineer is required to submit one complete set of maps bound along the left edge and backed by a heavy cover, such as brown paper, to REA with a final statement of engineering fees under a "mapping only" contract. This group of maps will not be folded but shall be prepared for mailing by inserting them in a mailing tube or otherwise protecting the drawings. One print of all tracings shall be delivered to the Borrower. The Engineer shall deliver the tracings to the Borrower at such time as the Borrower shall direct.

b. MAPS REQUIRED FOR FINAL INVENTORY DOCUMENTS:

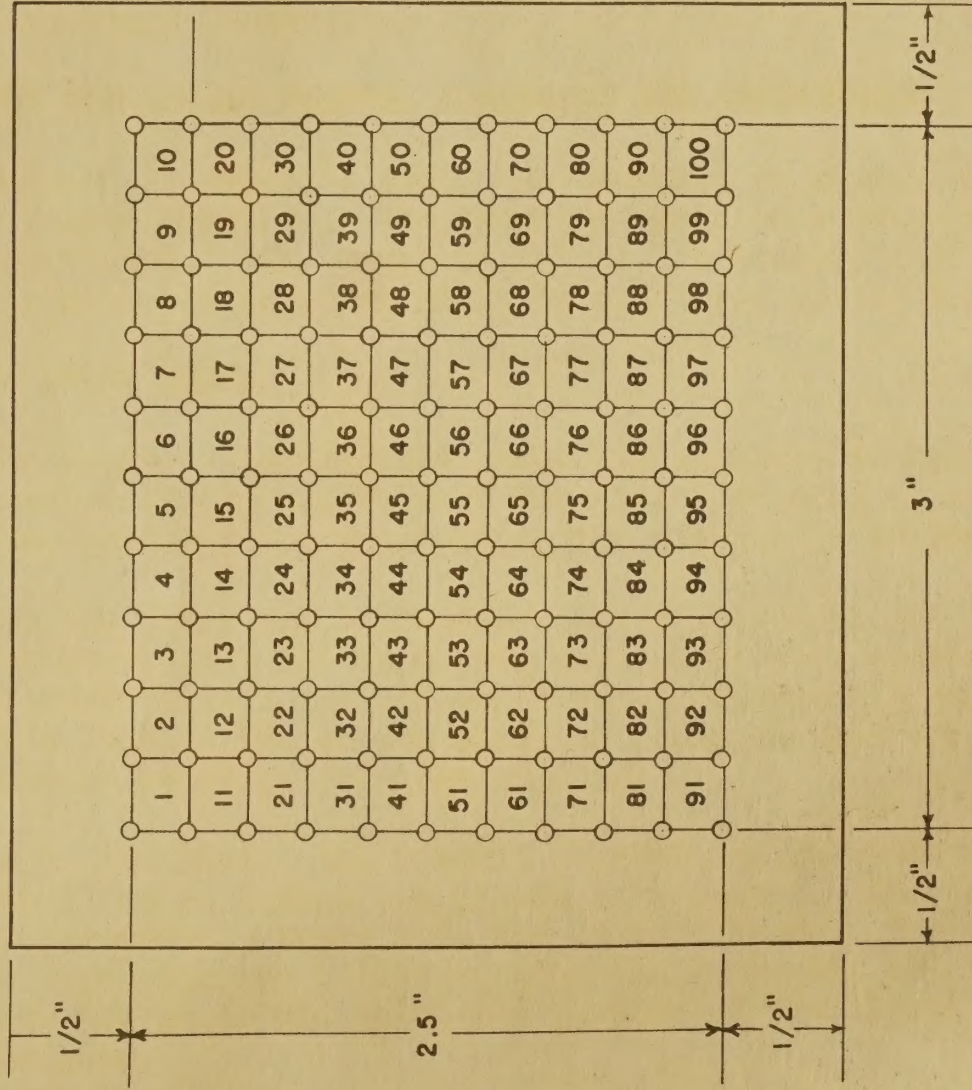
Under the Engineering Service Contract the Engineer is required to submit two copies of all maps to REA. One copy shall be prepared as required under "Mapping Contract." One copy of all maps shall be folded like a sample map with the map designation exposed. Both sets of maps shall include a copy of Substation Structure Drawings, Circuit Diagram and Electrical Data Sheet. The Engineer shall further identify the lines covered by the final inventory documents by marking the lines on the blue prints with red pencil. One bound copy and one unbound print of all tracings shall be delivered to the Borrower. The Engineer shall deliver the tracings to the Borrower at such time as the Borrower shall direct. The Engineer is required to supply all drawings in the same form as required for Final Inventory Documents.

c. DRAWINGS FOR LOCKER PLANTS, BUILDINGS AND STRUCTURES:

The Engineer is required under his contract to supply one complete set of folded drawings. The drawings shall be corrected to show "As Constructed." One complete set of "As Constructed" plans together with all tracings shall be delivered to the Borrower.

d. CIRCUIT STUDY DATA:

- (1) The Engineer is required under his contract to submit all Sectionalizing and Voltage Regulation Studies in triplicate (two copies to be retained by REA and one by Borrower).
- (2) All the forms and calculations as required by the Engineering Contract shall be bound into an appropriate, permanent folder together with a copy of the Circuit Diagram and the Electrical Data Sheet. The sheets shall be bound so that can be unfolded without removing from the binding.
- (3) As an alternate, the Circuit Diagram and Electrical Data Sheet can be folded and placed in a pocket. The pocket must be permanently bound into the Circuit Study. The folder shall be appropriately titled to show the contents, the project, the date the study was made, the purpose of the study, and the Engineer.



CELLULOID OR PLASTIC TEMPLATE (TRANSPARENT)

RURAL ELECTRIFICATION ADMINISTRATION
 DESIGN & CONSTRUCTION DIVISION
 AREA INDICATOR
 REA STANDARD MAP

